Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S6 (S, FE) / S4 (PT) (S, FE) Examination December 2024 (2019 Scheme)

Course Code: MET304

Course Name: DYNAMICS AND DESIGN OF MACHINERY

Max. Marks: 100 **Duration: 3 Hours**

*Recommended Machine Design Data book is allowed for use in examination hall

PART A

Answer all questions, each carries 3 marks. Marks

1	What is meant by Dynamics force analysis	(3)
2	Derive an expression for maximum fluctuation of energy in a flywheel	(3)
3	A vibrating system has the following data; m = 3 kg, k = 100 N/m, c = 3 Ns/m Determine damping factor in the system	(3)
4	What is the whirling speed of a shaft?	(3)
5	What are the steps in the design process	(3)
6	Define the following properties of material (i) Creep (ii) Resilience (iii) Fatigue	(3)
7	Explain notch sensitivity factor, q. What is the relationship between fatigue? stress concentration factor and q.	(3)
8	What is meant by caulking and fullering? Explain.	(3)
9	What are the advantages of welded joints over riveted joint	(3)
10	Why concentric springs are required in certain applications?	(3)

PART B

Answer any one full question from each module, each carries 14 marks.

Module I

11	A vertical petrol engine 100 mm diameter and 125 mm stroke has a connecting rod 250 mm long. The weight of the piston is 12 N. The speed is 2000 rpm. On the expansion stroke, with a crank 20^0 from Top Dead Centre, the gas pressure is 700 kN/m^2. Determine 1. Net force on the piston 2. Resultant load on the gudgeon pin 3. Crank pin effort 4. Thrust on the cylinder walls	(14)

OR

12 The turning moment diagram for a multi cylinder engine has been drawn to a scale 1 mm = 600 Nm vertically and 1 mm = 3° horizontally. The intercepted areas between the output torque curve and the mean resistance line, taken in order from one end, are as follows: + 52, – 124, + 92, – 140, + 85, – 72 and + 107 mm^2, when the engine is running at a speed of 600 rpm. If the total fluctuation of speed is not to exceed ± 1.5% of the mean, find the necessary mass of the flywheel of radius 0.5 m. (14)

Module II

13 a) Describe about types of damped systems (4)

b) A machine of mass 75 kg is mounted on springs and is fitted with a dashpot to damp out vibrations. There are three springs each of stiffness 10 N/mm and it is found that the amplitude of vibration diminishes from 38.4 mm to 6.4 mm in two complete oscillations. Assuming that the damping force varies as the velocity, determine: 1. The resistance of the dashpot at unit velocity. 2. The ratio of the frequency of the damped vibration to the frequency of the undamped vibration. 3. The periodic time of the damped vibration. (10)

OR

14 a) What is meant by vibration isolation? (4)

b) A machine part of mass 2 Kg vibrates in a viscous medium. A harmonic exciting force of 25 N acts on the part and causes resonant amplitude of 12.5 mm with a period of 0.2 sec. Determine the damping coefficient. If the frequency of the exciting force is changed to 4 Hz, determine the increase in the amplitude of forced vibration upon removal of the damper. (10)

Module III

15 a) Determine expressions of equation of motion and natural frequencies for the system shown **Fig. 1** (14)

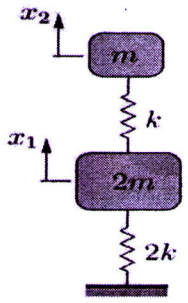

Fig. 1

OR

16 a) Explain briefly general consideration in designing a machine component (8)

b) Find the maximum stress induced in a rectangular plate 60 mm × 10 mm with a hole 12 mm diameter **(Fig. 2)** taking stress concentration into account: and subjected to a tensile load of 12 kN. (6)

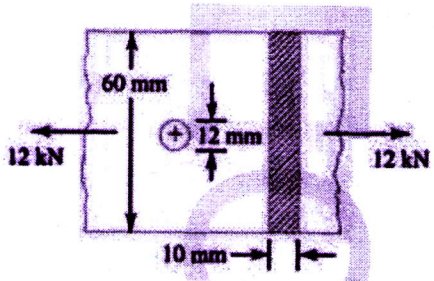

Fig. 2

Module IV

17 a) A steel cantilever is 200 mm long. It is subjected to an axial load which varies from 150 N (compression) to 450 N (tension) and also a transverse load at its free end which varies from 80 N up to 120 N down. The cantilever is of circular cross-section. It is of diameter 2d for the first 50mm and of diameter 'd' for the remaining length **(Fig.3).** Determine its diameter taking a factor of safety of 2. (14)

Assume the following values:

Yield stress = 330 Mpa

Endurance limit in reversed loading = 300 Mpa

Correction factors =0.7 in reversed axial Loading

= 1.0 in reversed Bending

Stress concentration factor = 1.44 for bending

= 1.64 for axial loading

Size effect factor = 0.85

Surface effect factor = 0.90

Notch sensitivity index = 0.90

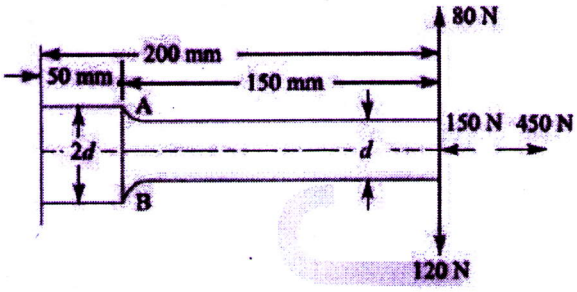

Fig.3

OR

18 a) Describe about type of rivet heads (4)

b) Design a double riveted lap joint for MS plates 9.5 mm thick. Calculate the efficiency of the joint. The permissible stresses are : Tensile stress = 90 MPa, Shear stress = 75 MPa, Crushing stress = 150 MPa (10)

Module V

19 a) Write a short note on different types of welded joint (4)

b) A bracket is welded to its support as shown in **Fig.4** (All dimensions are in mm). All welds are fillet welds of equal thickness. Determine size of weld if the permissible stress in the weld is 80 MPa. (10)

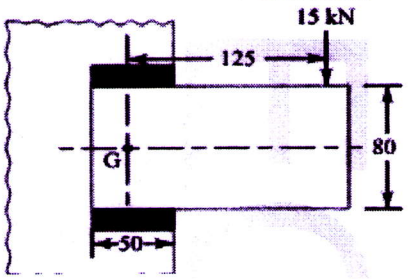

Fig. 4

OR

20 a) Derive an expression for the shear stress in the spring wire. (5)

b) A railway wagon weighing 3 tons is moving with a velocity of 3 m/s. It is brought to rest by two buffer springs of diameter 200 mm. The maximum deflection allowed is 160 mm. The allowable shear stress in spring material is 600 MPa. Take G=84 GPa. Design the spring. (9)

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